

REMARKS

Claims 1-3, 6, 9-14, 17, 20-22, 35, 40-48, and 54-56 were previously pending for examination. Claims 1, 2, 3, 6, 9-12, 35, 40-48, 54, and 55 are currently amended. Support for these amendments can be found, for example, in FIGS. 2 and 6 and the discussions thereof, and in paragraphs [0059] and [0060] of the application as published (U.S. Patent Pub. No. 2007/0007214 A1). No claims are currently added or canceled. As a result, claims 1-3, 6, 9-14, 17, 20-22, 35, 40-48, and 54-56 are currently pending for examination, with claims 1, 12, 35, 40, and 41 being independent claims. No new matter has been added.

Rejections under 35 U.S.C. § 103

I. Heine in view of Shimizu

Claims 1-3, 6, 9-14, 17, 20-22, 35, 40-42, and 54-56 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Heine et al. (US 6,126,819) (hereinafter “Heine”) in view of Shimizu et al. (US 5482625) (hereinafter “Shimizu”).

There is no *prima facie* case of obviousness of claims 1-3, 6, 9-14, 17, 20-22, 35, 40-48, and 54-56 over Heine in view of Shimizu. The asserted combination of Heine and Shimizu fails to disclose or suggest each and every element of any of these claims. Further, one of ordinary skill in the art would not have been motivated to have combined Heine and Shimizu *ab initio*.

A. Heine in view of Shimizu fails to disclose or suggest a plurality of membrane modules each comprising a plurality of porous membranes mounted in an upper pot supported by an upper header and a lower pot supported by a lower header.

Heine fails to disclose or suggest a plurality of membrane modules each having a plurality of porous membranes potted on both their upper and lower ends in upper and lower pots supported by upper and lower headers, respectively, as recited in each of independent claims 1, 12, 35, 40, and 41, as amended. Nor does Heine disclose or suggest a plurality of membrane modules each having a plurality of porous membranes configured to provide for permeate to be withdrawn from the upper ends of the porous membranes as recited in independent claims 1 and 35 or a plurality of membrane modules each having a plurality of porous membranes encased in a support structure as recited in independent claim 1.

Rather, Heine discloses a plurality of membrane elements 13 mounted on only a lower end in a support part 222 of a closure element 22 (Heine at FIGS. 5 and 7). The upper ends of the membrane elements 13 are unsupported (Heine at Col. 3, lines 55-58; Col. 8 lines 46-40). Heine discloses that this arrangement allows for the membrane elements to be “radially moveable” at their unsupported ends which provides an advantage that the membrane elements may move to dislodge “any clogging layer on the membrane surfaces” which “reduces the chances of the flow passages of the apparatus to become clogged.” (Heine at Col. 3, lines 58-65; Col. 9, lines 26-29.)

Shimizu cannot cure the failure of Heine to disclose or a plurality of membrane modules each having a plurality of porous membranes potted on both their upper and lower ends in upper and lower pots supported by upper and lower headers, as recited in each of independent claims 1, 12, 35, 40, and 41. This is because Shimizu does not disclose membranes mounted in any pot. Rather, Shimizu discloses plate-like, rigid membrane cartridges 110 including filtration membranes “adhered to [a] membrane supporting plate 118 with an adhesive or welded by heat or ultrasonic wave to [a] membrane supporting net 119” or fixed to a membrane supporting plate by means of adhesion or fusion. (Shimizu at Col. 2, lines 29-44; Col. 7, lines 7-11; Col. 10, lines 61-63; FIGS. 4 and 5 and the description thereof.)

Further, one of ordinary skill in the art would not have been motivated to have modified Heine in light of any other reference to include a plurality of membrane modules each having a plurality of porous membranes potted on both their upper and lower ends in upper and lower pots supported by upper and lower headers, respectively. Such a modification to Heine would negate the advantage of utilizing membrane elements potted at only a lower end disclosed by Heine with regard to the cleaning of the membrane elements.

One of ordinary skill in the art would recognize that membranes potted at only a lower end could not be utilized to withdrawn permeate from the upper ends of the membranes as recited in independent claims 1 and 35. One of ordinary skill would also not have been motivated to include a support structure encasing the membranes as recited in independent claim 1, as this would have restricted the movement of the membranes, reducing the affect of such movement for cleaning the membranes as disclosed in Heine.

B. Heine in view of Shimizu fails to disclose or suggest a gas inlet constructed and arranged to introduce gas into a mixing chamber in a downward direction from above the open base end, said gas fed from above and through a manifold

Heine fails to disclose or suggest a single gas inlet constructed and arranged to introduce gas into a mixing chamber in a downward direction from above an open base end of the mixing chamber, said gas fed from above and through a manifold and into the mixing chamber, said gas inlet horizontally centered between at least two of said plurality of membrane filtration modules, as recited in independent claims 1 and 35, as amended. There is no disclosure anywhere in Heine of any particular method or structure for introducing gas into the apparatus disclosed.

Shimizu cannot cure the failure of Heine to disclose or suggest this element of independent claims 1 and 35 because the gas diffuser 504 of Shimizu feeds gas into the filtration module through tubes entering the filtration module from a horizontal direction, not from above. (Shimizu FIG. 24.) To modify the gas diffuser 504 of Shimizu to introduce gas from above would require a fundamental change to the design and operation of the filtration module of Shimizu. There is no suggestion in Heine or Shimizu that would lead one of ordinary skill in the art to make such a modification to the gas diffuser of Shimizu.

Heine in view of Shimizu also fails to disclose or suggest “a gas inlet constructed and arranged to introduce gas into [a mixing] chamber in a downward direction from above the open base end [of the mixing chamber], said gas fed from above and through [a] manifold” as recited in independent claim 12, as amended or “a gas inlet positioned within the open-ended mixing chamber, the gas inlet spaced from and surrounded by side walls of the open-ended mixing chamber and configured to feed gas into the open-ended mixing chamber from above and through [a] manifold” as recited in independent claims 40 and 41, as amended for at least the same reasons discussed above.

The recitation of a membrane module including a single gas inlet constructed and arranged to introduce gas into a mixing chamber in a downward direction from above an open base end of the mixing chamber, said gas fed from above and through a manifold patentably distinguishes the claims of the present application over the asserted combination of Heine and Shimizu. To provide an air inlet for introducing air into a mixing chamber in a downward direction from above the open base end of a membrane filtration module as claimed provides for different operational characteristics for a membrane module than the arrangement of air inlets disclosed in Shimizu. For example, in the membrane module claimed, the air inlet has less cross

sectional area in the direction of feed flow than does the air diffuser 504 of Shimizu. This provides for less hardware present in the flow path of feed liquid into the filtration apparatus, which would result in lower flow resistance and energy requirements for operating the filtration apparatus.

C. Heine and Shimizu are not properly combinable *ab initio*

Heine and Shimizu would not have been combined in the manner asserted by one of ordinary skill in the art. Heine stresses the importance of avoiding placing objects in the flow path of feed through the filtration module which might deflect the flow path of feed through the module. (“As a result of the essentially linear flow passages without any deflections, the hydraulic resistance for the medium passing through the apparatus is low. Consequently, the required pressure for conducting the raw medium through the apparatus is relatively low so that also the energy requirements herefor [sic] are low.” “It is always the aim to provide the least possible hydrodynamic resistance for the liquid medium to be separated within the apparatus.” Heine at Col. 2, line 67 - Col. 3, line 5; Col. 4 lines 53-55.) Including the air diffuser 504 of Shimizu in the central passage 250 of Heine, would, however, do just that – the air diffuser 504 is an object which would partially block the flow of feed through the module and thus increase the feed flow resistance and the energy required to pump feed through the module. As such, Heine teaches away from including an air diffuser such as that disclosed in Shimizu in the feed flow path of the filtration module disclosed, and one of ordinary skill in the art would not have been motivated to make such a combination of Heine and Shimizu.

Further, one of ordinary skill in the art, would not, upon a reading of Heine and Shimizu have been motivated to include the diffuser of Shimizu within the apparatus of Heine and then modify the diffuser such that it comprised an air inlet which passed through the manifold and into the alleged mixing chamber of Heine from above the mixing chamber. There is no suggestion in either of Heine or Shimizu that to do so would provide any advantage. In fact, one of ordinary skill in the art would find that to include such a downwardly extending air inlet to be disadvantageous in the apparatus of Heine because the air inlet would at least partially block at least one of the flow passageways of Heine, increasing the flow resistance of fluid through this flow passageway. In the apparatus claimed, there are no membranes or flow passages above the air inlet which the air inlet would block (See FIG. 2 of the present application). This however, is not the case in the apparatus of Heine.

As such, Heine and Shimizu are not properly combinable in the manner asserted because one of ordinary skill in the art would not have been motivated to have made such a combination.

Because the asserted combination of Heine and Shimizu cannot disclose or suggest each and every claim element of independent claims 1, 12, 35, 40, and 41 and because Heine and Shimizu would not have been combined in the manner asserted by one of ordinary skill in the art, independent claims 1, 12, 35, 40, and 41 and the claims that depend from these claims cannot be obvious over Heine in view of Shimizu.

Accordingly, reconsideration and withdrawal of the rejection of claims 1-3, 6, 9-14, 17, 20-22, 35, 40-48, and 54-56 under 35 U.S.C. § 103 over Heine in view of Shimizu is respectfully requested.

II. Zha in view of Shimizu

Claims 1-3, 6, 9-14, 17, 20-22, 35, 40-48, and 54-56 were rejected under 35 U.S.C. § 103(a) over Zha et al. (US 2001/0047962) (hereinafter “Zha”) in view of Shimizu.

There is no *prima facie* case of obviousness of claims 1-3, 6, 9-14, 17, 20-22, 35, 40-48, and 54-56 over Zha in view of Shimizu. The asserted combination of Zha and Shimizu fails to disclose or suggest each and every element of any of these claims. Further, one of ordinary skill in the art would not have been motivated to have combined Zha and Shimizu *ab initio*.

Zha discloses a membrane filtration module in which a “venturi device 12 intakes gas through inlet 13 [and] mixes or entrains the gas with liquid flowing through feed inlet 14” (Zha at paragraph [0041]). In all of the embodiments of the membrane filtration module disclosed in Zha, an air inlet integral to a wall of a venturi device 12 (Zha at FIG.1) which may comprise a jet assembly chamber 16, 57 (Zha at FIGS. 2 and 9), is disclosed as introducing air from a side of the membrane filtration module and perpendicular to an upward flow of feed from a feed inlet. Contrary to what is asserted in the Office Action, the jet type air nozzle of Zha is not distinct from the venturi device disclosed. Rather, the jet type air nozzle disclosed in Zha is a form of venturi device. (“With a venturi device it is possible to create gas bubbles and aerate the system without a blower. The venturi device 12 can be a venturi tube, **jet**, **nozzle**, ejector, eductor, injector or the like.” Zha at para. [0041].)

Zha does not disclose or suggest any a single gas inlet constructed and arranged to introduce gas into a mixing chamber in a downward direction from above an open base end of

the mixing chamber, said gas fed from above and through a manifold, said gas inlet horizontally centered between at least two of said plurality of membrane filtration modules and vertically displaced below said at least two of said plurality of membrane filtration modules as recited in independent claims 1 and 35, as amended. Zha also fails to disclose or suggest “a gas inlet constructed and arranged to introduce gas into [a mixing] chamber in a downward direction from above the open base end [of the mixing chamber], said gas fed from above and through [a] manifold” as recited in independent claim 12, as amended or “a gas inlet positioned within the open-ended mixing chamber, the gas inlet spaced from and surrounded by side walls of the open-ended mixing chamber and configured to feed gas into the open-ended mixing chamber from above and through [a] manifold” as recited in independent claims 40 and 41, as amended.

Shimizu cannot cure the failure of Zha to disclose or suggest these elements of independent claims 1, 12, 35, 40, or 41, because, as discussed above, Shimizu also does not disclose or suggest any gas inlet which directs gas into a mixing chamber from above and through any manifold.

Further, one of ordinary skill in the art would not have been motivated to have combined Zha with Shimizu in the manner asserted or to have modified Zha to include a gas inlet constructed and arranged to introduce gas into a mixing chamber in a downward direction from above the open base end of the mixing chamber. One of ordinary skill in the art would not have been motivated to modify the structure of the membrane filtration module of Zha to include these features because doing so would have required a fundamental alteration to the structure and method of operation of the membrane filtration module disclosed and would have resulted in a negation of at least one of the disclosed advantages provided by said structure.

Zha discloses that an advantage of the filtration module disclosed is to make it “possible to create gas bubbles and aerate the system without a blower” because “[w]hen a motive fluid passes through a venturi it generates a vacuum to draw the gas into the liquid flow and generate gas bubbles therein” (Zha at paragraphs [0041] and [0045]). “By using a venturi device or the like, it is possible to generate gas bubbles to scrub membrane surfaces without the need for a pressurized gas supply such as a blower [which] lowers the cost of operation [of the filtration system].” (Zha at paragraph [0045].) Zha further discloses that methods wherein “a gas is injected, usually by means of a pressurised blower, into a liquid system where a membrane module is submerged to form gas bubbles” suffer from several disadvantages. These methods “consume[] large amounts of energy, possibly form[] mist or froth flow reducing effective

membrane filtration area, and may be destructive to membranes. Moreover, in an environment of high concentration of solids, the gas distribution system may gradually become blocked by dehydrated solids or simply be blocked when the gas flow accidentally ceases.” (Zha at paragraph [0004].)

One of ordinary skill in the art would not have been motivated upon a reading of Zha to have replaced the venturi device of Zha with the air diffuser of Shimizu or to have modified the air nozzle disclosed in Zha so that it was inverted in the fluid flow path as this would have negated the benefits of using a venturi device as disclosed in Zha. Zha acknowledges that gas may be injected by means of a blower “into a liquid system where a membrane module is submerged to form gas bubbles” as is disclosed in Shimizu, however disparages such a method and discloses that such a method gives rise to numerous disadvantages. One of ordinary skill in the art would not have modified Zha as asserted in the Office Action because this would have resulted in the disadvantages disclosed in Zha without providing any advantage

Because the asserted combination of Zha and Shimizu cannot disclose or suggest each and every claim element of any of independent claims 1, 12, 35, 40, or 41, and because Zha and Shimizu would not have been combined in the manner asserted by one of ordinary skill in the art, independent claims 1, 12, 35, 40, or 41 and the claims that depend therefrom cannot be obvious over Zha in view of Shimizu.

Accordingly, reconsideration and withdrawal of the rejection of claims 1-3, 6, 9-14, 17, 20-22, 35, 40-48, and 54-56 under 35 U.S.C. § 103 over Zha in view of Shimizu is respectfully requested.

III. Zha and/or Heine in view of Shimizu and Henshaw

Claims 1-3, 6, 9-14, 17, 20-22, 35, 40-48, and 54-56 were rejected under 35 U.S.C. § 103(a) over Zha and/or Heine in view of Shimizu, and further in view of Henshaw (US 5,783,083).

There is no *prima facie* case of obviousness of claims 1-3, 6, 9-14, 17, 20-22, 35, 40-48, and 54-56 over Zha and/or Heine in view of Shimizu, and further in view of Henshaw. The asserted combination of Zha and/or Heine, Shimizu and Henshaw fails to disclose or suggest each and every element of any of these claims. Further, one of ordinary skill in the art would not have been motivated to have combined these references *ab initio*.

The Examiner relies on Henshaw for teaching a “plurality of submerged membrane modules arranged in manifolds to have enlarged capacity treatment systems.” Even if Henshaw discloses this, Henshaw fails to cure the defect of Zha and/or Heine in view of Shimizu discussed above to disclose or suggest each and every claim element of any of independent claims 1, 12, 35, 40, and 41 and the claims that depend from these claims. For example, the asserted combination of Zha and/or Heine, Shimizu and Henshaw fails to disclose a gas inlet constructed and arranged to introduce gas into a mixing chamber in a downward direction from above the open base end of the mixing chamber, said gas fed from above and through a manifold as recited in independent claims 1, 12, 35, 40, and 41 or the claims which depend from these claims.

The reasons why one of ordinary skill in the art would not have been motivated to have combined Zha and/or Heine with Shimizu are discussed above. These reasons apply equally well to the asserted combination of Zha and/or Heine, Shimizu and Henshaw.

As such, each of claims 1-3, 6, 9-14, 17, 20-22, 35, 40-48, and 54-56 is patentable the asserted combination of Zha and/or Heine, Shimizu and Henshaw. Accordingly, reconsideration and withdrawal of the rejection of claims 1-3, 6, 9-14, 17, 20-22, 35, 40-48, and 54-56 under 35 U.S.C. § 103 over Zha and/or Heine, Shimizu and Henshaw is respectfully requested.

Provisional Double Patenting Rejection

Claims 1-22, 35, 40-48, and 54-56 were provisionally rejected on the ground of non-statutory obviousness-type double patenting as being unpatentable over the claims in co-pending Application No. 11/025,418 in view of Shimizu. Claims 4, 5, 7, 8, 15, 16, and 19 were previously cancelled, rendering the provisional double patenting rejection of these claims moot. Applicants respectfully disagree that any of claims 1-3, 6, 9-14, 17, 20-22, 35, 40-48, and 54-56 of the instant application should be rejected on the ground of obviousness-type double patenting. Notwithstanding this traversal, Applicants will submit a terminal disclaimer with respect to co-pending Application No. 11/025,418 once the instant claims are deemed allowable.

CONCLUSION

Applicants respectfully request reconsideration of the claims in view of the foregoing amendments and remarks. The application as presented is in condition for allowance. An early and favorable action is respectfully requested. If the Examiner believes, after this Response, that the application is not in condition for allowance, the Examiner is invited to call Applicants' representative at the telephone number listed below.

If this Response is not considered timely filed and if a request for an extension of time is otherwise absent, Applicants hereby request any necessary extension of time. If there is a fee occasioned by this response, including an extension fee that is not covered by an enclosed payment, please charge any deficiency to Deposit Account No. 50/2762 (Ref. No. M2019-7027US).

Respectfully submitted,
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